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Harris et al.

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(54) **CHEMICAL DISPENSING APPARATUS AND RELATED METHODS**

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B01F 5/04	(2006.01)
B01F 13/10	(2006.01)

(52) **U.S. Cl.**

CPC ***B01F 3/08*** (2013.01); ***B01F 3/0865*** (2013.01); ***B01F 5/0428*** (2013.01); ***B01F 13/1055*** (2013.01); *B01F 2003/0896* (2013.01); *B01F 2215/004* (2013.01)

(58) **Field of Classification Search**

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USPC 222/135, 145.5, 145.1, 145.6, 160, 416, 222/181.2; 141/100, 9, 165

See application file for complete search history.

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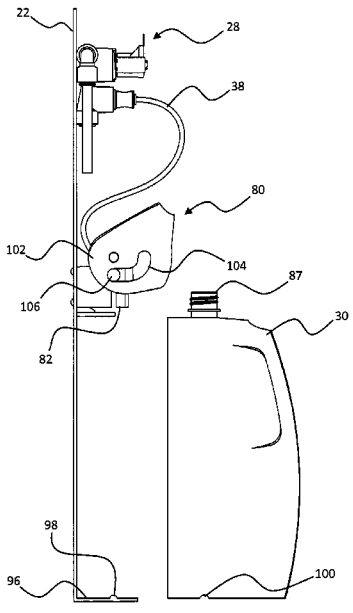
(57) **ABSTRACT**

A chemical dispensing assembly having injector assemblies that combine a solvent stream with a concentrate stream within a Venturi injector assembly to produce a chemical solution outlet stream. Each injector assembly has an interchangeable metering assembly that limits the flow of concentrate into the Venturi injector assembly to change the resulting concentration of the concentrate within the solution outlet stream. The chemical dispensing assembly also has a keyed connector system that prevents the connection of the wrong concentrate container to the wrong injector assembly.

13 Claims, 16 Drawing Sheets



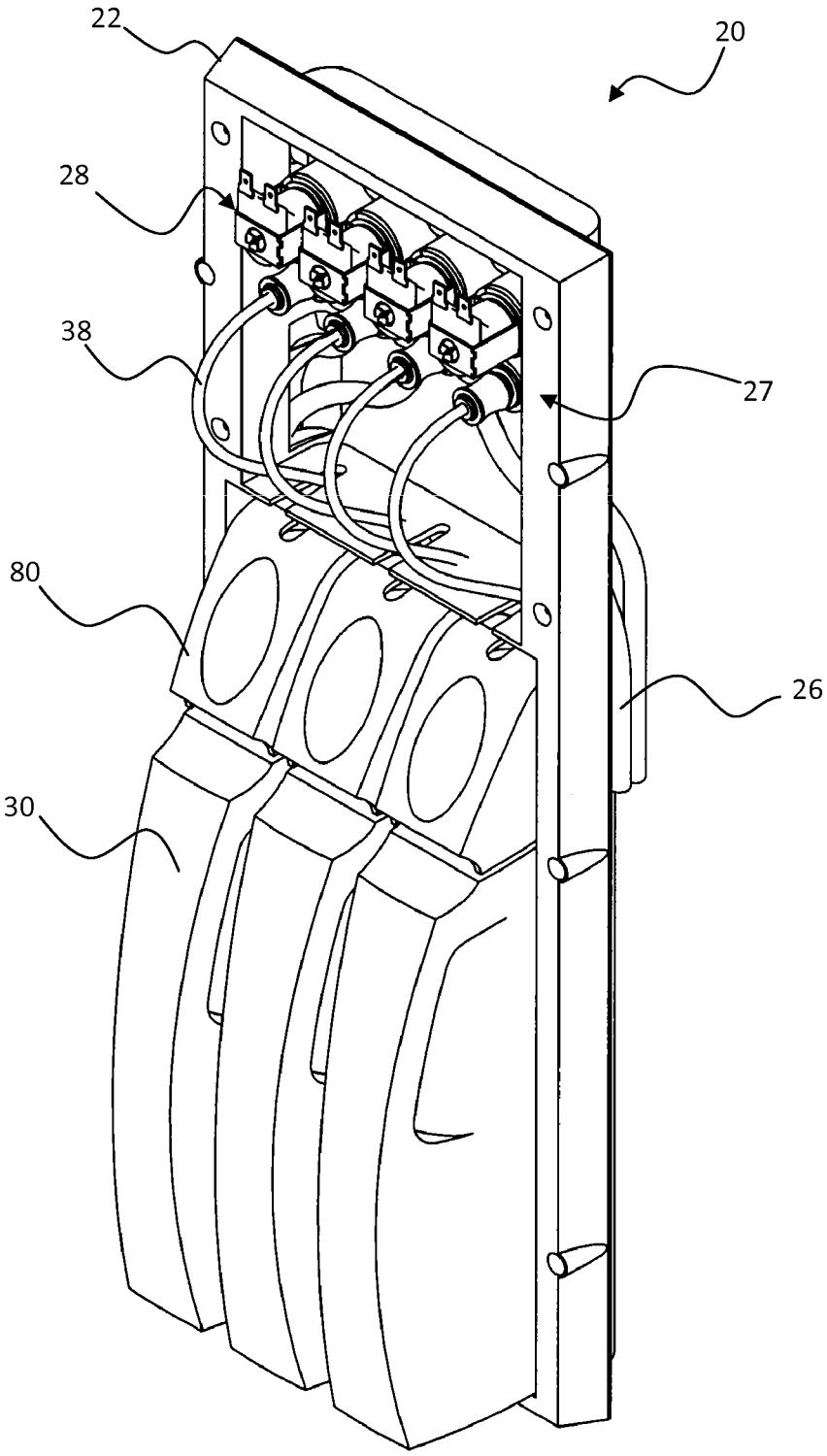


Figure 1

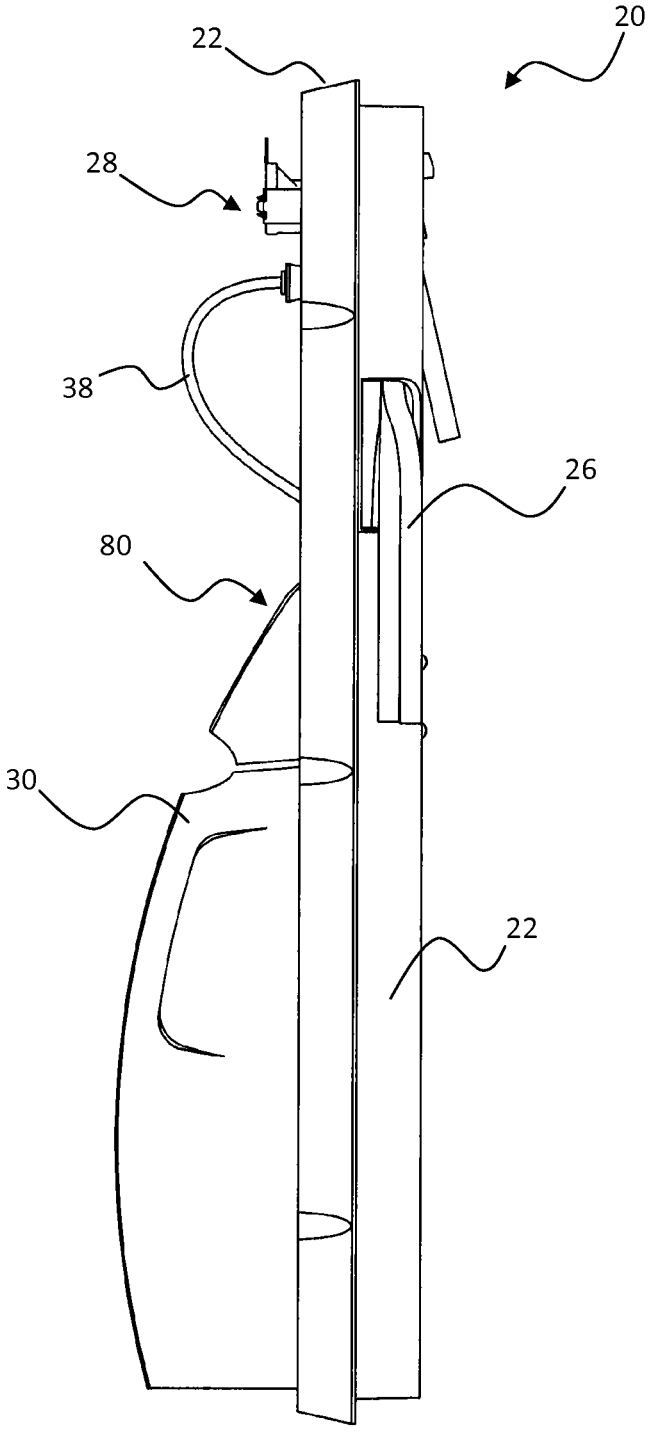


Figure 2

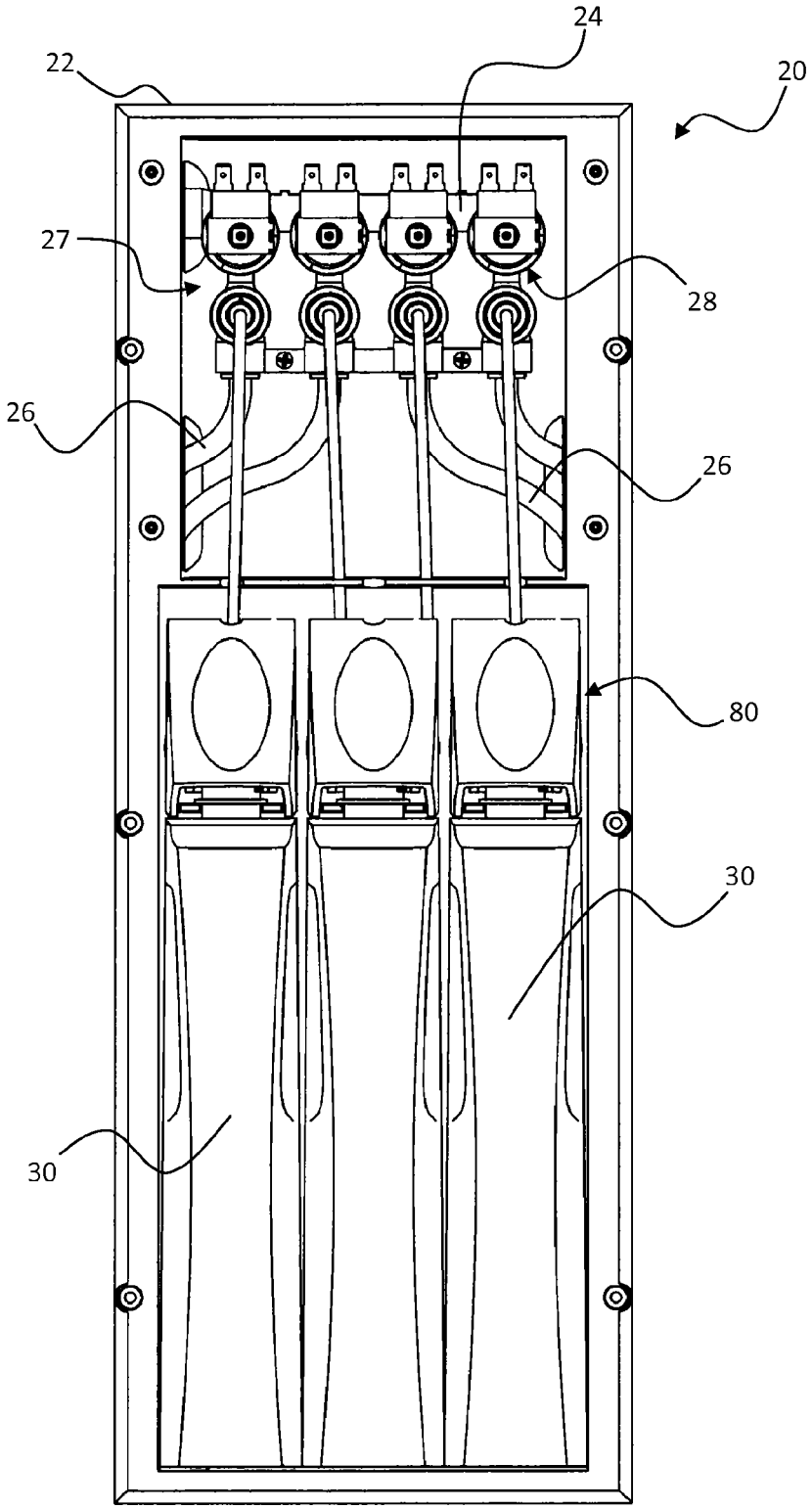
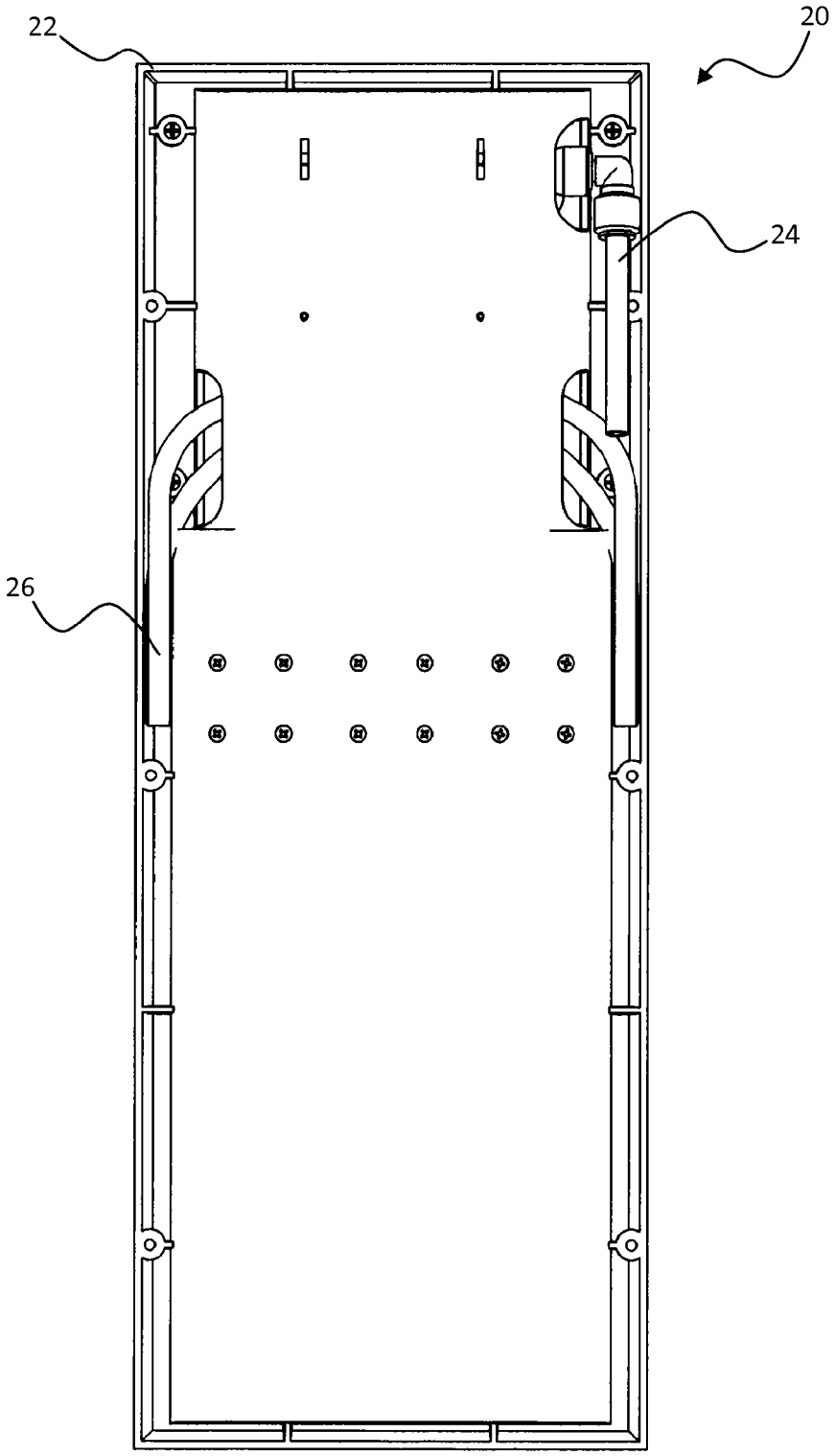


Figure 3



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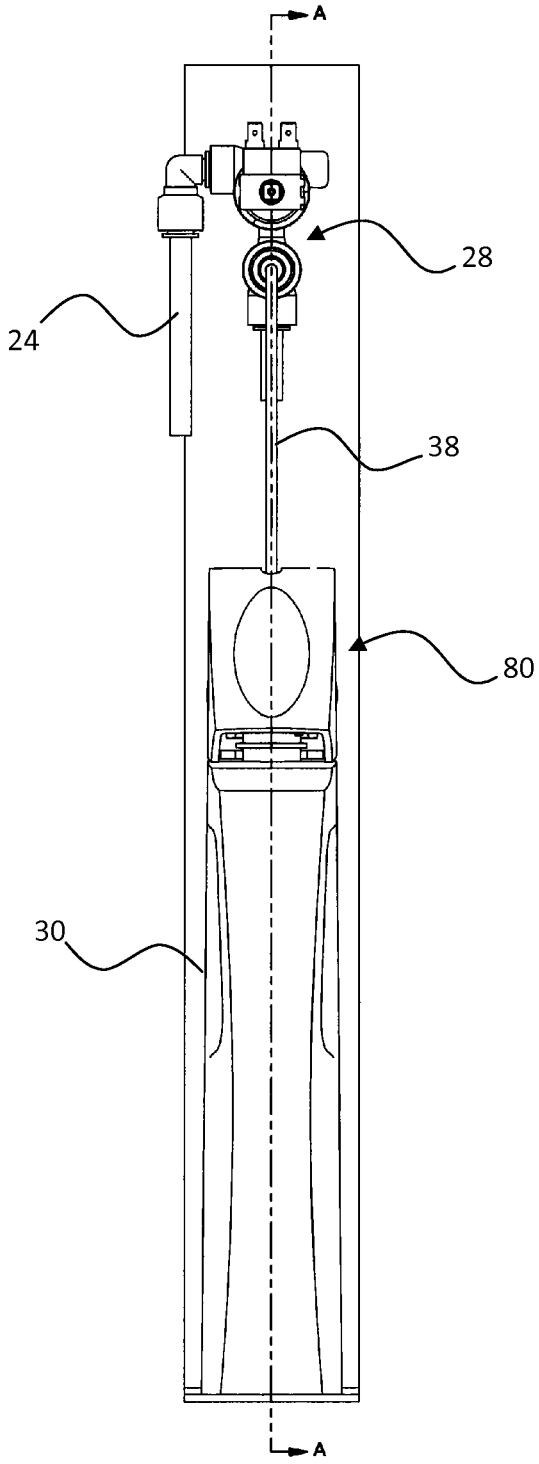


Figure 5

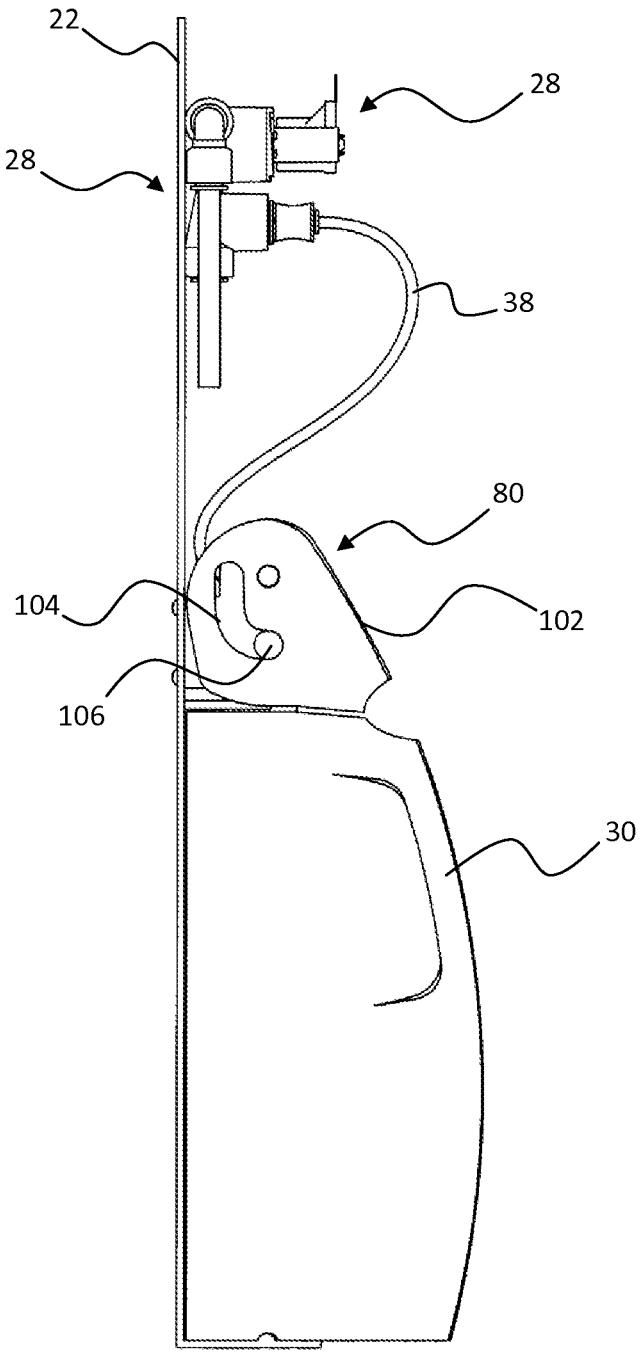


Figure 6

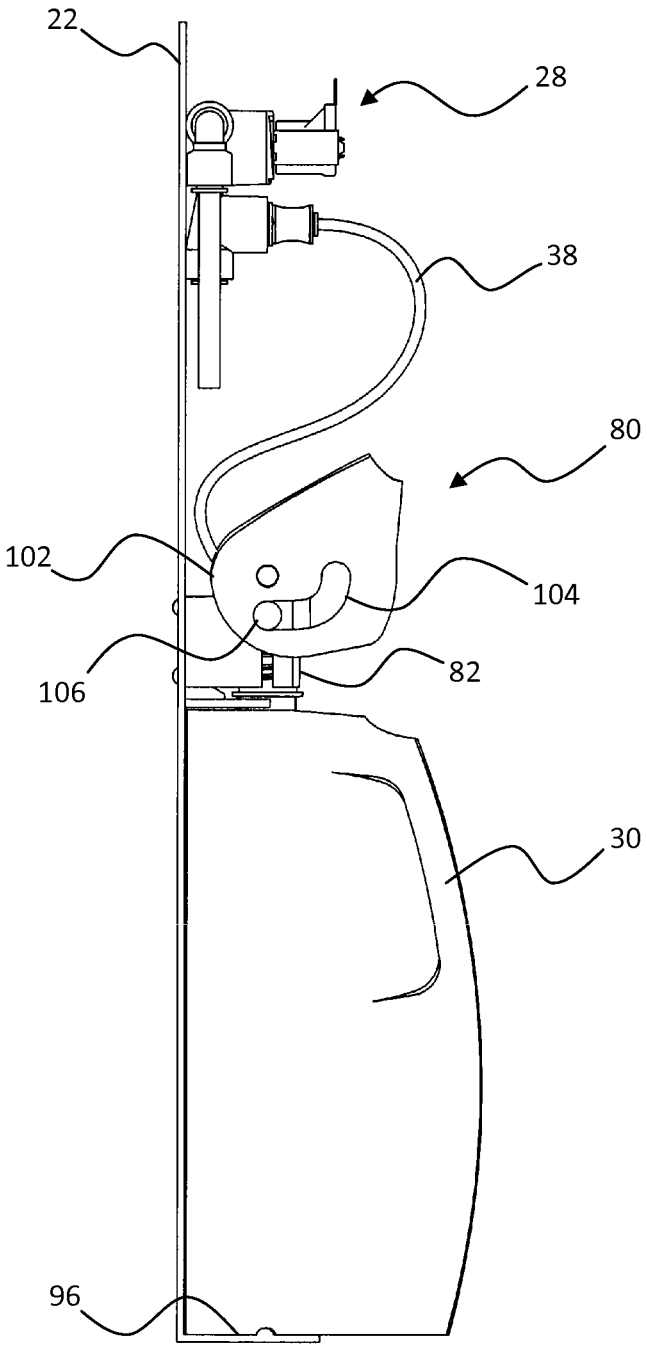


Figure 7

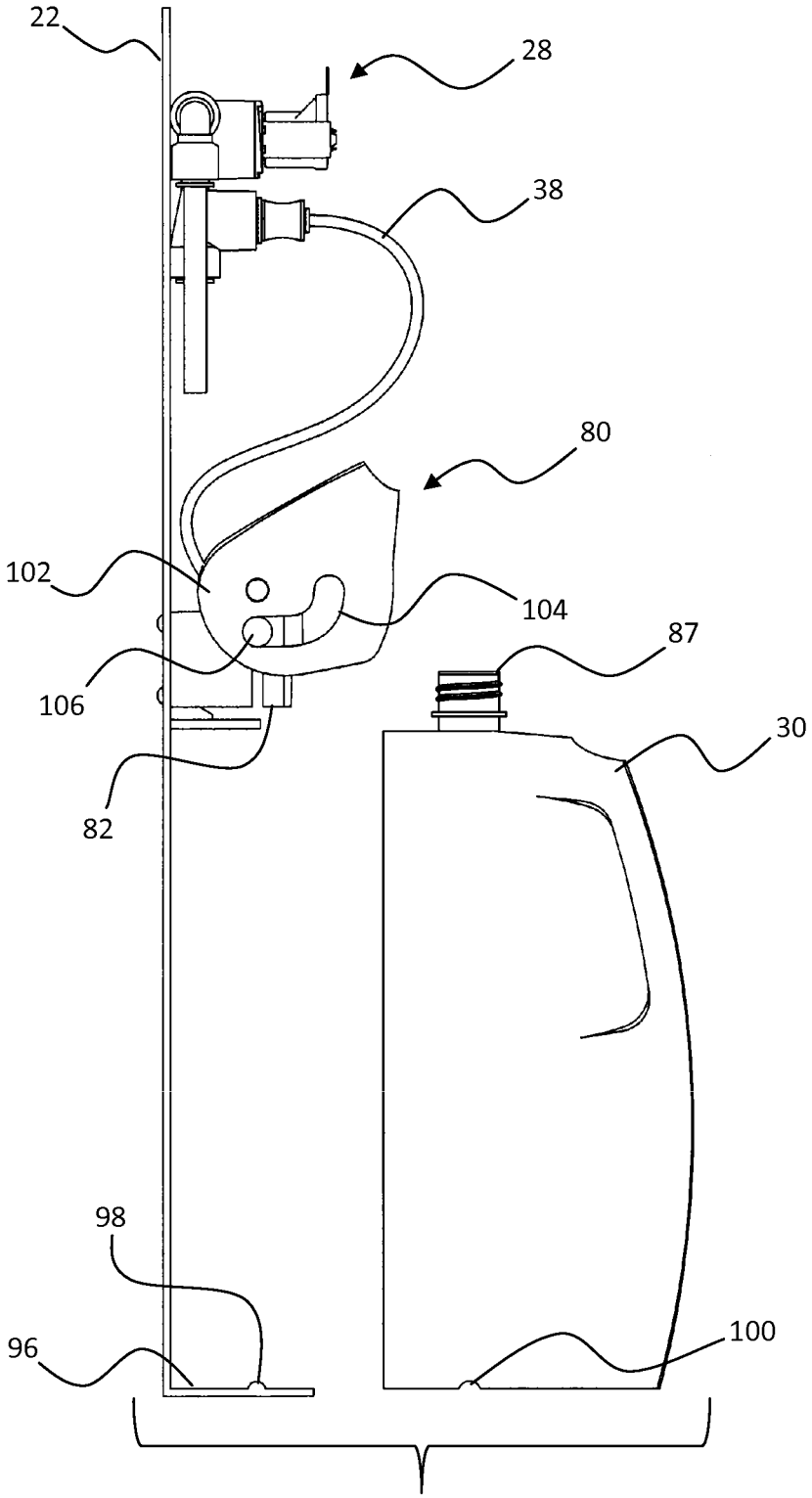
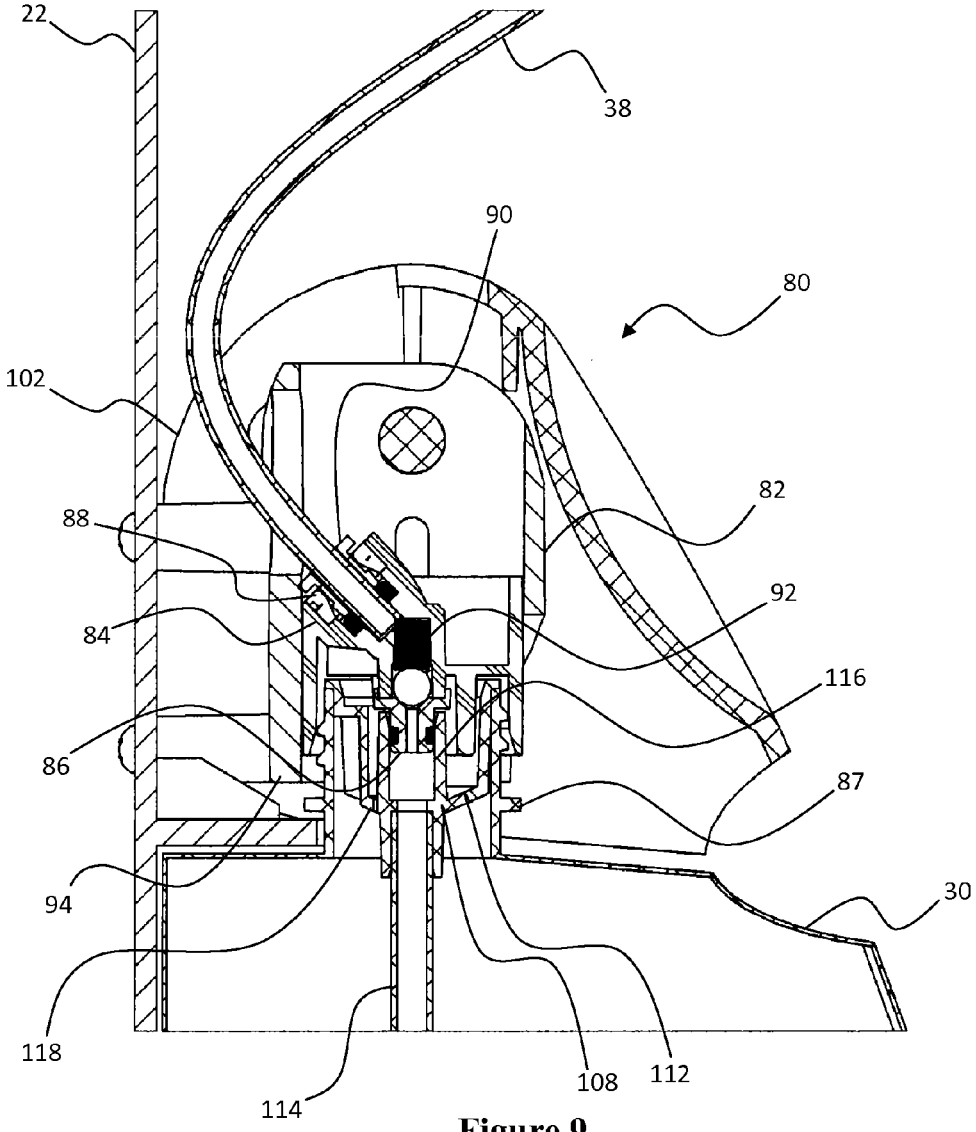


Figure 8



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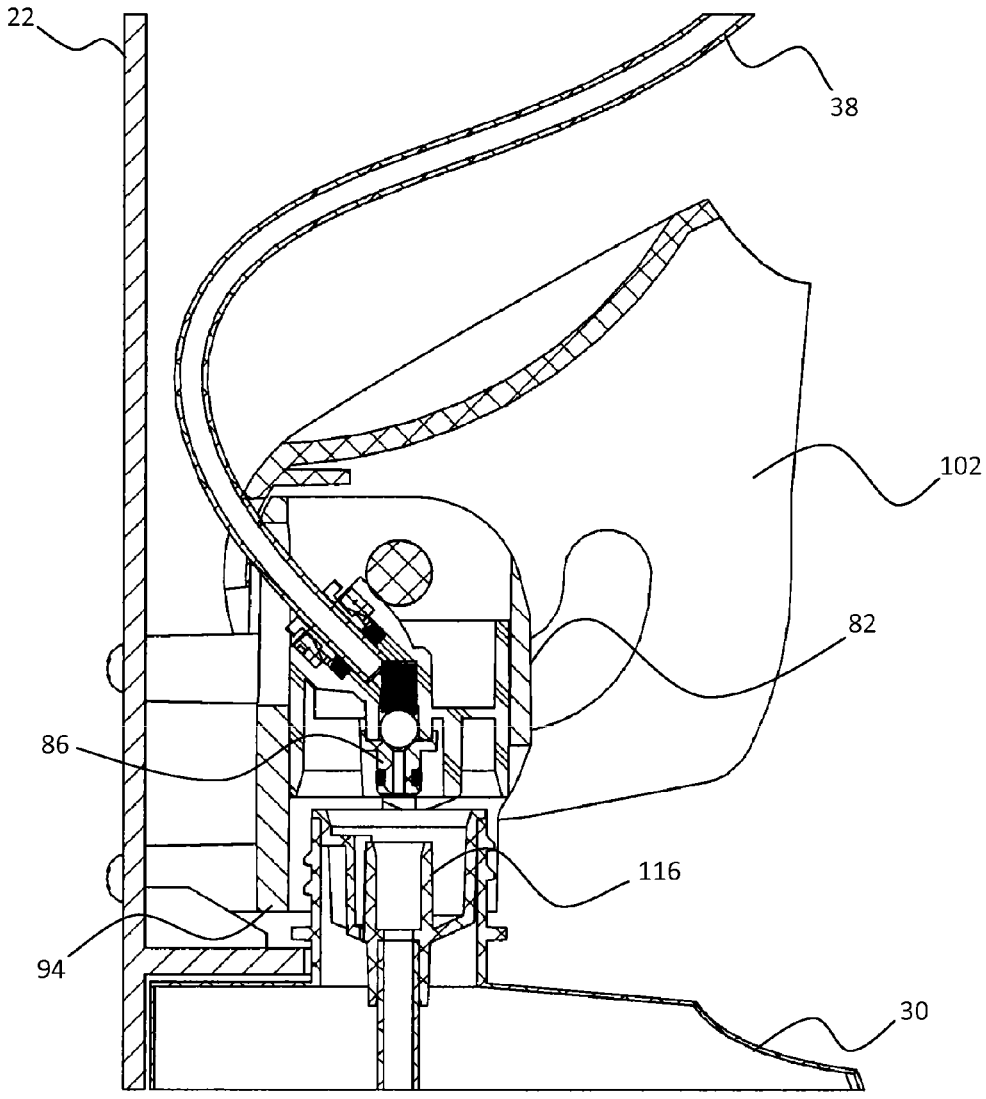

Figure 10

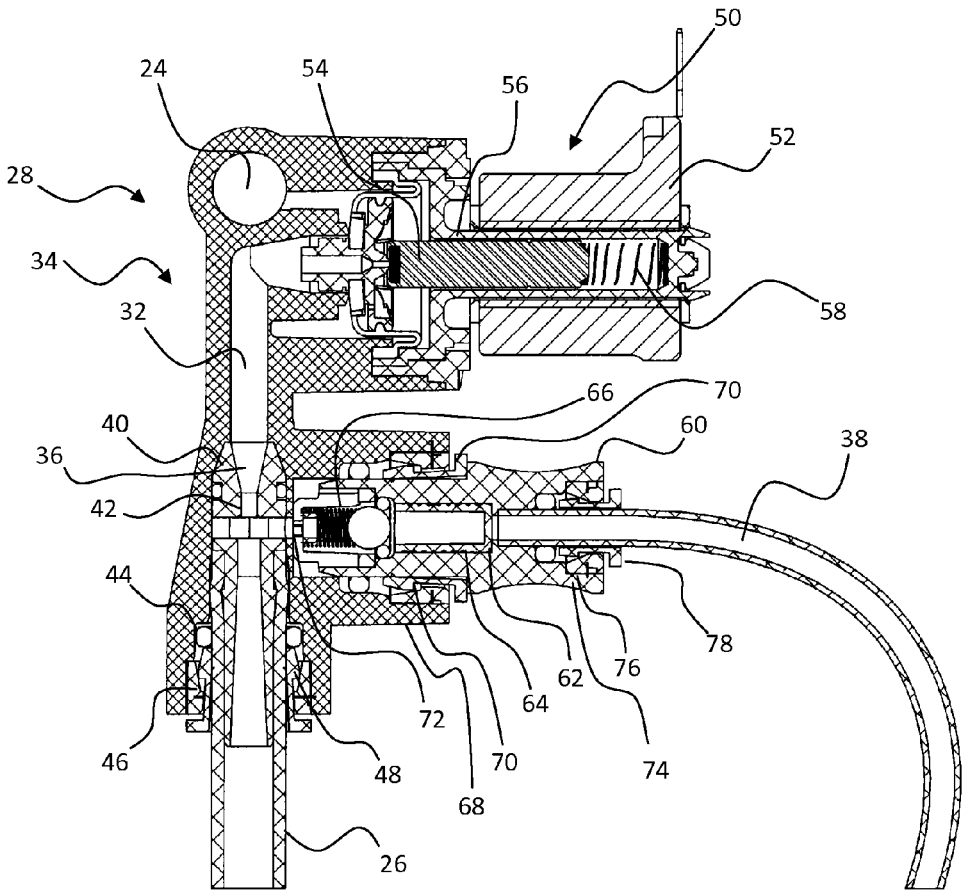
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Figure 11

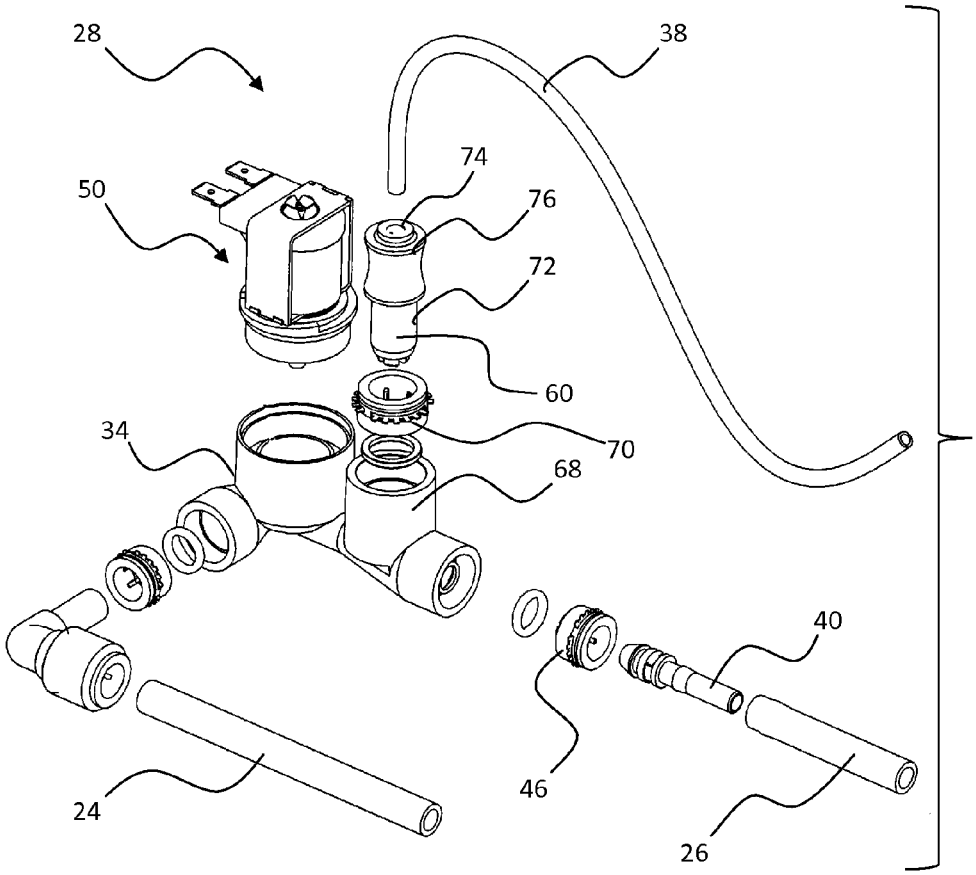

Figure 12

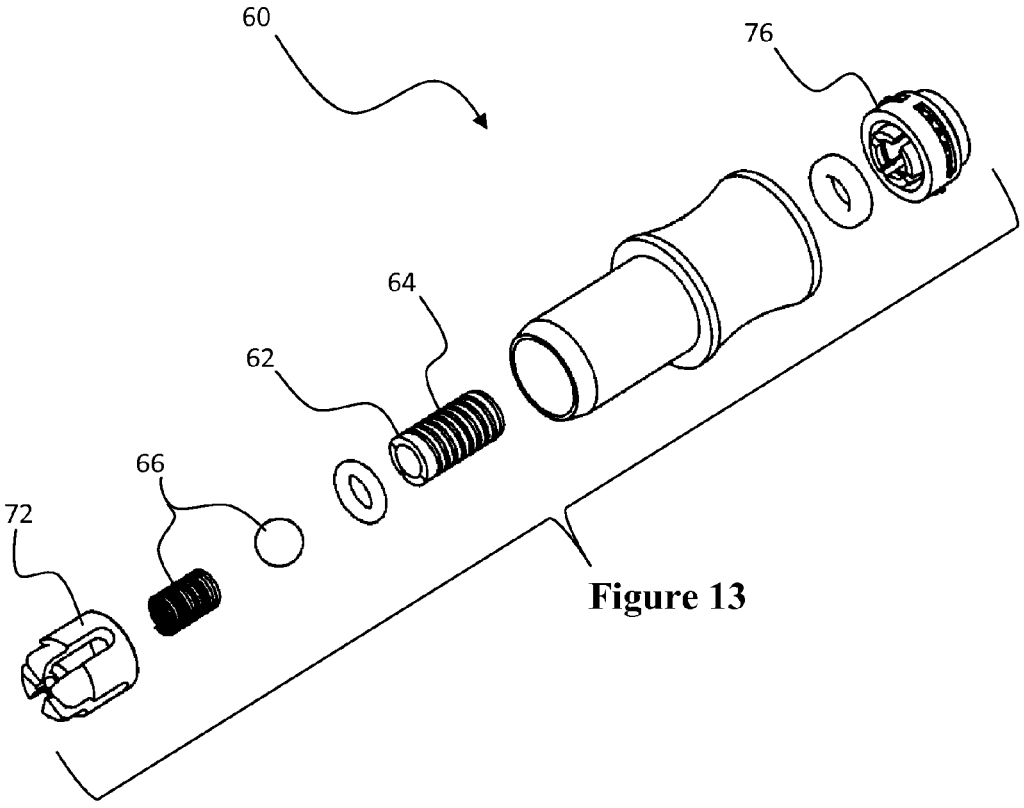

Figure 13

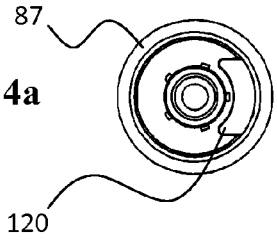

Figure 14a

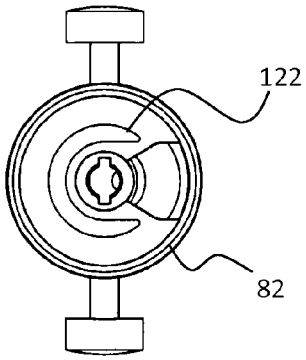

Figure 14b

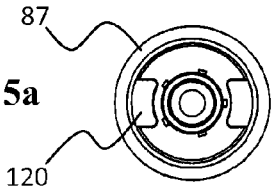

Figure 15a

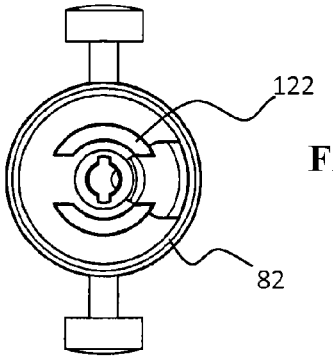

Figure 15b

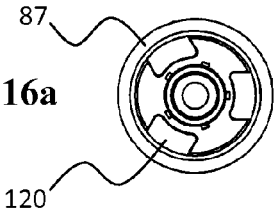

Figure 16a

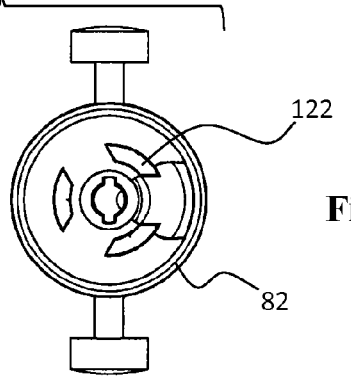

Figure 16b

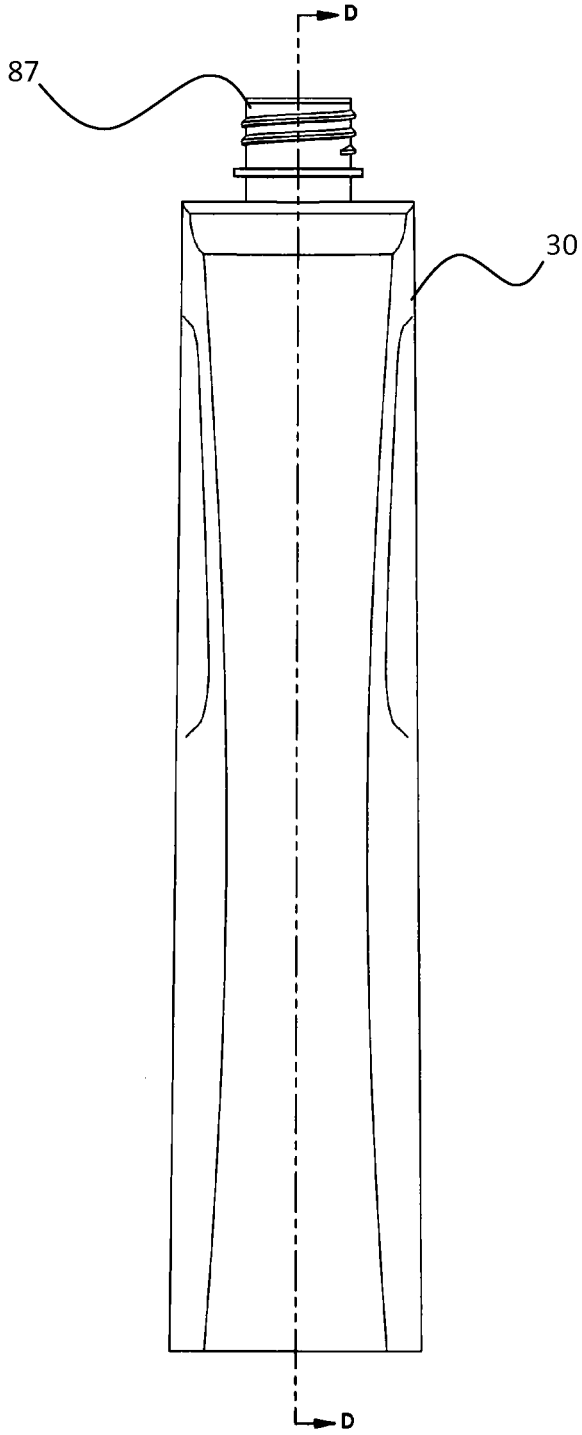

Figure 17

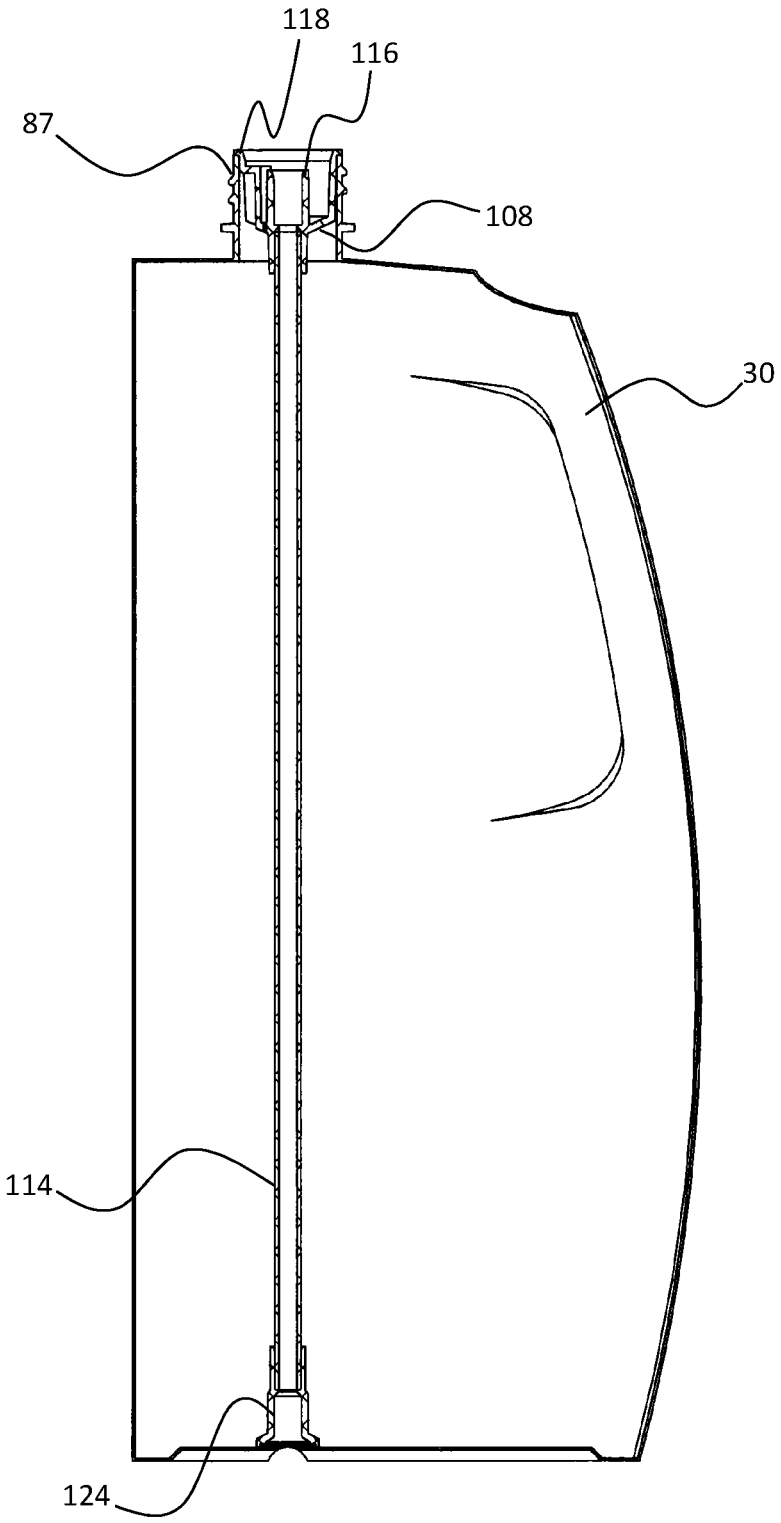

Figure 18

CHEMICAL DISPENSING APPARATUS AND RELATED METHODS

RELATED APPLICATION

The present application claims the benefit of U.S. Provisional Application No. 61/593,118 entitled CHEMICAL DISPENSING APPARATUS AND RELATED METHODS and filed Jan. 31, 2012, which is incorporated herein in its entirety.

FIELD OF THE INVENTION

The present invention is generally directed to a chemical dispensing apparatus and related methods of mixing chemical solutions from concentrates and dispensing the mixed chemical solutions. Specifically, the present invention is directed to a chemical dispensing apparatus capable of sequentially mixing a plurality of chemical solutions from different concentrates and dispensing the mixed solutions through a single conduit or shared conduits.

BACKGROUND OF THE INVENTION

Many chemical systems create a plurality of chemical solutions by mixing various concentrates with a solvent stream, typically water, before dispensing the mixed chemical solutions from the chemical system. The chemical solutions are often mixed sequentially such that each chemical solution can be individually fed into a shared outlet for use. Specifically, the systems often provide a continuous solvent stream to which the concentrates are sequentially added to create a plurality of segments in the solvent stream that comprise the desired chemical solutions. Alternatively, a slug of solvent is combined with a slug of concentrate to form a quantity of solution that is fed into the outlet. The sequential mixing of the chemical solutions allow a single system to provide a plurality of different chemical solutions from concentrates that are incompatible or would be less effective if combined into a single chemical solution. Similarly, the sequential mixing can allow certain chemical solutions to be applied in specific sequences providing additional advantages. A common application for the sequential systems is automated car washes and other cleaning systems in which cleaning, rising, and protective chemical solutions are applied sequentially to a vehicle or object to be cleaned.

A primary consideration for the mixing systems is efficiently mixing each of the chemical solutions such that chemical solution can be quickly mixed and dispensed through the common outlet before the next chemical solution is prepared. Typically, a diaphragm or similar valve draws a slug of fluid from the concentrate container and combines the concentrate slug with a solvent stream or a solvent slug to create a chemical solution stream. When a solvent stream is provided, the diaphragm valve is often operated to draw a series of slugs to provide a continuous solution stream. In this configuration, an inherent challenge is mixing the slug flow of the concentrate stream with the continuous solvent stream such that the concentrate is evenly distributed throughout the solvent stream at the appropriate concentration. Similarly, selecting the appropriate slug size and frequency to create the appropriately concentrated solution stream can be particularly challenging and be varied depending on the type of concentrate. With slug solvent flow, creating the appropriate sized solvent slug for the corresponding concentrate slug can be particularly challenging. An additional challenge is that the non-continuous slug flow can place greater strain on the valves and other systems than a continuous flow system.

A common consideration for the mixing systems is resupplying the mixing system when one or more of the concentrates is exhausted. The mixing systems often comprise a plurality of interface assemblies each connectable to an individual concentrate supply container to draw concentrate from the supply container. The mixing systems are often automated to draw the predetermined amounts of concentrate from the connected concentrate supply container at pre-programmed times or if the controller determines that the specific chemical solution is required. However, if the incorrect concentrate container is connected to the interface the wrong concentrate will be combined with the solvent stream resulting in the incorrect chemical solution being created. The systems often use many different concentrates with equally many different interfaces making connecting the correct concentrate container difficult. In addition, many concentrates can have similar names and appearances further increasing the challenge for operators to correctly replace the concentrate containers.

Although mixing systems capable of providing a plurality of different chemical solutions individually provide numerous advantages, a number of challenges still remain regarding the efficient and accurate mixing of the chemical solutions as well as an accurate means of resupplying the system with additional concentrate.

SUMMARY OF THE INVENTION

The present invention is generally directed to a chemical dispensing assembly comprising a dispensing manifold further comprising at least one injector assembly for combining a solvent stream with a concentrate stream drawn from a concentrate container to form a chemical solution stream. Each injector assembly comprises a secondary line extending between a motive fluid inlet and a common outlet assembly and further comprising a Venturi injector assembly through which the solvent stream is directed to create a vacuum at the necked portion of the Venturi injector assembly. A concentrate tube connected to the concentrate container at one end and fluidly connected to the necked portion of the Venturi injector assembly at the other end allows the vacuum created by the flow of the solvent stream through the necked portion to draw concentrate from the concentrate container into Venturi injector assembly and combine the concentrate stream with the solvent stream. The amount of concentrate drawn is directly proportional to the flow rate of solvent through the Venturi injector assembly providing an accurate and consistent means of mixing the chemical solution at the correct concentration.

In certain aspects of the present invention, the concentrate tube can further comprise a metering assembly positioned at the end of the concentrate tube engaged to the Venturi injector assembly. The metering assembly can further comprise a restrictor plug that reduces the cross-sectional area of the concentrate tube limiting the flow of concentrate drawn through the concentrate tube by the vacuum created by the flow of the solvent stream through the venture injector assembly. In one aspect, the restrictor plug can further comprise a channel sized to defining an opening through which concentrate can be drawn by the vacuum. The number of turns, the diameter of the channel, the angle of the channel and other channel characteristics and dimensions can be varied to change the flow of concentrate around the restrictor plug. In certain aspects, the restrictor plug can be interchanged with restrictor plugs in which the channels have different characteristics to provide a different concentrate flow rate thereby

regulating the concentration of the resulting chemical solution. In one aspect, the metering assembly can further comprise a one-way valve allowing fluid to be fed into the Venturi injector assembly from the concentrate container, but preventing backflow of fluid from the Venturi injector assembly.

In certain aspects of the present invention, the chemical dispensing assembly can further comprise a locking assembly for securing the concentrate container to the concentrate tube. The locking assembly further comprises an engagement head to which the end of concentrate tube opposite the metering assembly is attached. The engagement head is movable between an engaged position in which the end of the concentrate tube is fluidly connected to the opening of the concentrate container and a disengaged position in which the concentrate tube is disconnected from the concentrate container. In one aspect, the locking assembly can further comprise a one-way valve allowing fluid to be drawn from the concentrate container, but preventing backflow of fluid into the concentrate container. In one aspect, the chemical dispensing assembly can further comprise a container support shelf for supporting the concentrate container. In this configuration, the container support shelf can comprise an alignment element engagable to the concentrate container to position the concentrate container such that the container opening is aligned with the engagement head for fluidly connecting the concentrate tube with the concentrate container when the engagement head is moved into the engaged position.

In one aspect, the concentrate container further comprises a container insert having a keyed connector operably linked to a concentrate tube. The keyed connector is positioned at the opening of the concentrate container. In this configuration, the engagement head further comprises a corresponding connector interfacing with the keyed connector to link the concentrate tube to the concentrate tube when the engagement head is positioned in the engaged position. Each keyed connector comprises at least one tab interfacing with at least one tab of the corresponding connector, wherein the arraignment, positioning and/or size of the tabs are varied to prevent connection of keyed connector with non-corresponding connectors. The keyed connectors prevent attachment of the wrong concentrate containers to the injector assembly. In one aspect, the concentrate tube can further comprise a screen or filter to prevent solids, participated crystals or other particulates from entering the concentrate tube and being drawn into the injector assembly.

In another aspect, a chemical dispensing assembly, according to an embodiment of the present invention, can comprise a motive fluid inlet, an outlet assembly, at least one concentrate container and at least one injector assembly comprising a secondary line linking the motive fluid inlet to the outlet assembly. The injector assembly further comprises a concentrate tube and a Venturi injector assembly having a necked portion. In operation, the concentrate tube fluidly connects the necked portion of the Venturi injector assembly with the concentrate container, wherein feeding a solvent stream from the motive fluid inlet through the Venturi injector assembly creates a vacuum in the necked portion drawing concentrate from the concentrate container and combining the concentrate stream with the solvent stream. In certain embodiments, the concentrate tube can further comprise a metering assembly having an interchangeable restrictor plug constricting the flow of concentrate through the concentrate tube to change the resulting concentration of the mixed chemical solution. In certain embodiments, the injector assembly can further comprise an engagement head movable to fluidly connect and disconnect the end of the concentrate tube with the concentrate container. In this configuration, the container can further comprise an insert positioned in the opening of the container and comprising a keyed connector preventing fluid connection of the concentrate tube with the container when the wrong container is used.

In yet another aspect, a method of formulating a chemical solution comprising drawing a solvent stream from a motive fluid inlet and directing the solvent stream through a Venturi injector assembly such that the solvent stream enters a necked portion of the Venturi injector assembly creating a vacuum at the necked portion. The method further comprises fluidly connecting the necked portion of the Venturi injector assembly and a concentrate container with a concentrate tube to draw a concentrate stream from the concentrate container with the vacuum created in the necked portion. The method also comprises a positioning a first restrictor plug within the concentrate tube comprising a first channel having a first cross-sectional area smaller than the cross-sectional area of the concentrate tube to reduce the effective cross-sectional area of the tube limiting the flow of the concentrate stream through the concentrate tube. The method further comprises exchanging the first restrictor plug with a second restrictor plug comprising a second channel having a second cross-sectional area different from the first cross-sectional area of the first channel.

The above summary of the various representative embodiments of the invention is not intended to describe each illustrated embodiment or every implementation of the invention. Rather, the embodiments are chosen and described so that others skilled in the art can appreciate and understand the principles and practices of the invention. The figures in the detailed description that follow more particularly exemplify these embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention can be completely understood in consideration of the following detailed description of various embodiments of the invention in connection with the accompanying drawings, in which:

FIG. **1** is a perspective view of a chemical dispensing assembly according to an embodiment of the present invention.

FIG. **2** is a side view of the chemical dispensing assembly depicted in FIG. **1**.

FIG. **3** is a front view of the chemical dispensing assembly depicted in FIG. **1**.

FIG. **4** is a rear view of the chemical dispensing assembly depicted in FIG. **1**.

FIG. **5** is an isolated front view of an injector assembly and a concentrate container according to an embodiment of the present invention.

FIG. **6** is a side view of the injector assembly and concentrate container depicted in FIG. **5**, wherein the concentrate container is fluidly connected to the injector assembly.

FIG. **7** is a side view of the injector assembly and concentrate container depicted in FIG. **5**, wherein the concentrate container is positioned for fluid connection to the injector assembly.

FIG. **8** is a side view of the injector assembly and concentrate container depicted in FIG. **5**, wherein the concentrate container is removed from the chemical dispensing assembly.

FIG. **9** is a cross-sectional side view of a locking assembly according to an embodiment, wherein the locking assembly is positioned to fluidly connect an injector assembly with a concentrate container.

FIG. **10** is a cross-sectional side view of the locking assembly depicted in FIG. **5**, wherein the locking assembly is posi-

tioned to disconnect the fluid connection between the injector assembly and the concentrate container.

FIG. **11** is a cross-sectional side view of an injector assembly according to an embodiment of the present invention.

FIG. **12** is an exploded view of an injector assembly according to an embodiment of the present invention.

FIG. **13** is an exploded view of metering assembly of the present invention.

FIG. **14***a* is a top view of a container insert according to an embodiment of the present invention.

FIG. **14***b* is a bottom view of an engagement head according to an embodiment of the present invention.

FIG. **15***a* is a top view of a container insert according to an embodiment of the present invention.

FIG. **15***b* is a bottom view of an engagement head according to an embodiment of the present invention.

FIG. **16***a* is a top view of a container insert according to an embodiment of the present invention.

FIG. **16***b* is a bottom view of an engagement head according to an embodiment of the present invention.

FIG. **17** is a front view of a concentrate container according to an embodiment of the present invention.

FIG. **18** is a side cross-sectional view of a concentrate container having a container insert according to an embodiment of the present invention.

While the invention is amenable to various modifications and alternative forms, specifics thereof have been shown by way of example in the drawings and will be described in detail. It should be understood, however, that the intention is not to limit the invention to the particular embodiments described. On the contrary, the intention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the invention as defined by the appended claims.

DETAILED DESCRIPTION

As depicted in FIGS. **1-4** and **11**, a chemical dispensing assembly **20**, according to an embodiment of the present invention, comprises a mounting frame **22**, an inlet line **24**, a solution outlet line **26** and a dispensing manifold **27** having at least one injector assembly **28** fluidly connectable to at least one concentrate container **30**. The mounting frame **22** comprises connection points for securing and positioning the inlet line **24**, the solution outlet line **26** and each injector assembly **28**. The inlet line **24** is fluidly connectable to a motive fluid inlet for supplying a quantity of solvent or a solvent stream to the injector assembly **28**. Similarly, the solution outlet line **26** is fluidly connectable to an outlet assembly for receiving and using the mixed chemical solution output from the injector assembly **28**. The injector assembly **28** comprises a secondary line **32** fluidly connecting the inlet line **24** with the solution outlet line **26**. As depicted in FIGS. **1-4**, a plurality of injector assemblies **28** can be operably linked to a single inlet line **24** and each linked to an individual solution outlet line **26**. In other embodiments, the plurality of injector assemblies **28** can have individual inlet lines **24** and/or a shared solution outlet line **26**. In other embodiments, the chemical dispensing assembly **20** can have a single inlet line **24**, a single injector assembly **28** and a single solution outlet line **26**.

As depicted in FIGS. **1**, **3**, **5** and **11**, each injector assembly **28** can further comprise an injector assembly **34**, a concentrate supply line **38** and a Venturi injector assembly **40** defining a necked portion **42**. The injector assembly **34** defines the secondary line **32** linking the inlet line **24** with the solution outlet line **26**. The concentrate supply line **38** is fluidly connected to the secondary line **32** at one end through a port **36** in the necked portion **42** of the Venturi injector assembly **40**. The opposite end of the concentrate supply line **38** is fluidly connectable to the concentrate container **30**. In operation, the Venturi injector assembly **40** is positioned in the secondary line **32** such that the solvent stream from the inlet line **24** is directed through the necked portion **42** and undergoes a pressure change to create a vacuum at the necked portion **42**. The vacuum created at the necked portion **42** draws concentrate from the concentrate container **30** to entrain and mix the concentrate within the solvent stream to produce a chemical solution stream or a quantity of chemical solution.

As depicted in FIGS. **11** and **13**, in certain embodiments, the injector assembly **34** can further comprise a port **44** comprising at least one engagement element **46**, such as a protruding tab, engagable with a corresponding engagement element **48** on the solution outlet line **26**. The port **44** can further comprise an o-ring, gasket or other sealing means for preventing leakage at the interface between the port **44** and the solution outlet line **26**.

As depicted in FIG. **11**, in certain embodiments, the injector assembly **28** can further comprise an inlet valve **50** controlling flow of the solvent from the inlet line **24**. As depicted in FIG. **11**, the inlet valve **50** can comprise a solenoid valve comprising a valve housing **52**, a plunger **54**, a solenoid coil **56** and a spring **58**, wherein the spring **58** biases the plunger **54** to obstruct the secondary line **32** preventing flow of solvent through the secondary line **32** until a current is supplied to the solenoid coil **56** to induce an electromagnetic field retracting the plunger **54**. In other embodiments, the inlet valve **50** can comprise a diaphragm valve and other conventional valve type capable electronic control of the flow of solvent through the secondary line **32**.

As depicted in FIG. **11**, each injector assembly **28** can further comprise a metering assembly **60** comprising a restrictor plug **62** aligned with the concentrate supply line **38** to reduce the effective cross-sectional area of the concentrate supply line **38**. The metering restrictor plug **62** effectively plugs the concentrate supply line **38** and comprises a helical channel **64** defining a restricted flow path past the restrictor plug **62**. In certain embodiments, the helical channel **64** draws concentrate through the helical channel **64** through capillary action assisted by the vacuum created by the necked portion **42** of the Venturi injector assembly **40**. The number of turns, the diameter of the channel **64**, the angle of the turns of the channel **64** and other channel **64** characteristics and dimensions can be varied to change the flow of concentrate through the restrictor plug **62**. In certain embodiments, the restrictor plug **62** can be interchanged with restrictor plugs **62** having different channel characteristics to provide a different concentrate flow rate to alter the resulting concentration of the mixed chemical solution. In certain embodiments, the metering assembly **60** can further comprise a ball valve **66** biased to only allow one-way flow of the concentrate into the necked portion **42** while preventing back flow of the mixed chemical solution into the concentrate supply line **38**.

As depicted in FIG. **11**, in certain embodiments, the metering assembly **60** can comprise a modular arrangement in which the metering assembly **60** can be replaced to install different metering assembly **60** having a restrictor plug **62** having different channel characteristics thereby changing the flow rate of concentrate into the Venturi injector assembly **40**. In this configuration, the injector assembly **34** can further comprise a port **68** comprising at least one engagement element **70**, such as a protruding tab, engagable with a corresponding engagement element **72** on the metering assembly **60**. The port **68** can further comprise an o-ring, gasket or other sealing means for preventing leakage at the interface between the port **68** and the metering assembly **60**. Similarly, the

metering assembly **60** can further comprise a port **74** comprising at least one engagement element **76**, such as a protruding tab, engagable with a corresponding engagement element **78** on the concentrate supply line **38**. The port **74** can further comprise an o-ring, gasket or other sealing means for preventing leakage at the interface between the metering assembly **60** and the concentrate supply line **38**.

As depicted in FIGS. **6-10**, in certain embodiments, the chemical dispensing assembly **20** can further comprise a locking assembly **80** for fluidly connecting the concentrate supply line **38** with the concentrate container **30**. The locking assembly **20** further comprises a engagement head **82** for receiving an end of the concentrate supply line **38** and movable in a vertical axis between an engaged position in which the end of the concentrate supply line **38** is fluidly connected with the concentrate container **30** and a disengaged position in which the end of the concentrate supply line **38** is disconnected from the concentrate container **30**. The engagement head **82** further comprises a port **84** fluidly connected to an adapter **86** insertable into a mouth **87** of the concentrate container **30** to fluidly connect the concentrate supply line **38** with the concentrate container **30** when the engagement head **82** is moved into the engaged position. The port **84** further comprises at least one engagement element **88**, such as a protruding tab, engagable with a corresponding engagement element **90** on the concentrate supply line **38** to fluidly connect the concentrate supply line **38** to the adapter **86**. In certain embodiments, the engagement head **82** can further comprise a ball valve **92** biased to only allow one-way flow of the concentrate into the adapter **86** from the concentrate container **30** while preventing back flow of solution or concentrate from the concentrate supply line **38**.

As depicted in FIGS. **6-10**, in certain embodiments, the locking assembly **80** can further comprise a track **94** for aligning the engagement head **82** with the concentrate container **30** and guiding the engagement head **82** as the engagement head **82** moves vertically between the engaged position and the disengaged position. In this configuration, the mounting frame **22** can further comprise a support shelf **96** for receiving and supporting the concentrate container **30** as depicted in FIGS. **6-8**. The support shelf **96** can further comprise an alignment element **98** engagable to corresponding notch **100** in the concentrate container **30** to align the mouth **87** of the concentrate container **30** with the adapter **86**.

As depicted in FIGS. **6-10**, the locking assembly **80** can further comprise a rotatable handle **102** comprising a non-linear notch **104**. In this configuration, the engagement head **82** further comprises a protrusion **106** receivable within the notch **104**, wherein the notch **104** is oriented and shaped such that rotation of the handle **102** applies a downward or upward force on the engagement head **82** to move the engagement head **82** between the engaged position and the disengaged position. In certain embodiments, the notch **104** is curved to retain resist vertical movement of the engagement head **82** when the adapter **86** is inserted into the mouth **87** of the concentrate container **30** to prevent inadvertent disengagement of the adapter **86** from the concentrate container **30** while concentrate is being drawn from the concentrate container **30**.

As depicted in FIGS. **9-10** and **17-18**, the chemical dispensing assembly **20** can further comprise a container insert **108** insertable into the concentrate container **30**. The container insert **108** further comprises a keyed connector **112** and a concentrate tube **114**. The keyed connector **112** further comprises an overlapping adapter **116** for receiving the adapter **86** of the engagement head **82** when the engagement head **82** is positioned in the engaged position to fluidly connect the concentrate supply line **38** with the concentrate tube **114**. In certain embodiments, the keyed connector **112** further comprises a mouth interface **118** for aligning the overlapping adapter **116** with the center of the mouth **87** of the concentrate container **30** and preventing concentrate from leaking past the overlapping adapter **116** when the engagement head **82** is positioned in the disengaged position or when the concentrate container **30** is being connected to the chemical dispensing assembly **20**. The concentrate tube **114** is sized to extend the length of the concentrate container **30** to draw concentrate from the bottom of the concentrate container **30**. In one aspect, the concentrate tube **114** can further comprise a screen or filter **124** to prevent solids, participated crystals or other particulates from entering the concentrate tube and being drawn into the injector assembly **28**.

As depicted in FIGS. **14-16**, the container insert **108** can further comprise at least one keyed tab **120** positioned proximate to the overlapping adapter **116**. In this configuration, the engagement head **82** can further comprise at least keyed tab **122** paired with the keyed tab **120** of the container insert **108**. Each paired keyed tabs **120**, **122** are shaped to mirror or misaligned with the corresponding keyed tab **120**, **122** such that the engagement head **82** can be moved into the engaged position with the mouth **87** of the container **30** without engagement of the keyed tabs **120**, **122**. If mismatched pair of keyed tabs **120**, **122** is used, the keyed tabs **120**, **122** are engaged as the engagement head **82** is moved into the engaged position preventing connection of the adapter **86** with the overlapping adapter **116** thereby preventing fluid connection of the concentrate supply line **38** with the concentrate container **30**. In certain embodiments, the keyed tabs **120**, **122** can be oriented radially or axially to prevent an incorrect keyed tab **120**, **122** from moving past the opposing keyed tab **120**, **122** without engagement.

While the invention is amenable to various modifications and alternative forms, specifics thereof have been shown by way of example in the drawings and described in detail. It is understood, however, that the intention is not to limit the invention to the particular embodiments described. On the contrary, the intention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the invention as defined by the appended claims.

The invention claimed is:

1. A chemical dispensing assembly, comprising:

a manifold assembly defined by a plurality of injector assemblies, the manifold assembly having a motive fluid inlet supplying a motive fluid to an inlet line, each injector assembly including an inlet valve assembly and a venturi injector assembly;

a plurality of locking assemblies, each locking assembly including an engagement head and a rotatable handle, wherein the engagement head is fluidly coupled to a concentrate supply line and a concentrate tube; and

a plurality of concentrate containers, each concentrate container having a container mouth adapted for engagement by the engagement head such that the concentrate tube is retained within the concentrate container,

wherein each engagement head of the locking assemblies includes a head protrusion residing within a non-linear track of the rotatable handle of a respective locking assembly such that rotating the rotatable handle causes the engagement head to move non-rotatably vertically from a disengaged position to an engaged position thereby selectively disengaging or engaging the container mouth,

wherein, upon engagement of the container mouth with the engagement head, selective actuation of each inlet valve

assembly directs flow of the motive fluid to each corresponding venturi injector assembly such that a concentrated chemical within the corresponding concentrate container is conveyed through the corresponding concentrate tube and into the corresponding concentrate supply line, and

wherein the concentrated chemical is introduced into the motive fluid within the venturi assembly such that a mixed solution is dispensed through a solution outlet line on the venturi injector assembly.

2. The chemical dispensing assembly of claim **1**, wherein each venturi injector assembly includes a metering assembly including a restrictor plug, said restrictor plug reducing an effective cross-sectional area of the corresponding concentrate supply line to control flow of the concentrated chemical into the venturi injector assembly.

3. The chemical dispensing assembly of claim **2**, wherein each restrictor plug is individually replaceable such that the effective cross-sectional area can be varied to change the flow of the concentrated chemical into the venturi injector assembly.

4. The chemical dispensing assembly of claim **1**, wherein each engagement head includes a keyed head and each container mouth includes a keyed mouth such that the engagement head is adapted for engagement to concentrated containers having a corresponding keyed mouth.

5. The chemical dispensing assembly of claim **4**, wherein the keyed head and the keyed mouth comprise one or more keyed tabs.

6. The chemical dispensing assembly of **1**, further comprising a mounting frame, wherein the manifold assembly and the plurality of locking assemblies are attached to the mounting frame.

7. The chemical dispensing assembly of claim **6**, wherein the mounting frame includes a support shelf, wherein the plurality of concentrate containers are positioned on the support shelf, each concentrate container being positioned below the corresponding locking assembly.

8. The chemical dispensing assembly of claim **1**, wherein in the engaged position of the engagement head, the non-linear track is configured to prevent an adapter of the engagement head from disengaging with the concentrate container.

9. The chemical dispensing assembly of claim **8**, wherein the adapter of the engagement head fluidly couples the concentrate supply line to the concentrate tube of the concentrate container.

10. The chemical dispensing assembly of claim **9**, the engagement head further comprising a one-way valve configured to allow one-way flow of the concentrate into the adapter from the concentrate container.

11. The chemical dispensing assembly of claim **1**, wherein a container insert is mounted within the container mouth, the container insert including a container key, wherein the container key engages an engagement head key on the corresponding engagement head.

12. The chemical dispensing assembly of claim **11**, wherein the concentrate tube is fluidly connected to the container insert.

13. A chemical dispensing assembly, comprising:

a manifold assembly defined by an injector assembly, the manifold assembly having a motive fluid inlet supplying a motive fluid to an inlet line, the injector assembly including an inlet valve assembly and a venturi injector assembly;

a locking assembly including an engagement head and a rotatable handle, wherein the engagement head is fluidly coupled to a concentrate supply line and a concentrate tube; and

a concentrate container having a container mouth adapted for engagement by the engagement head such that the concentrate tube is retained within the concentrate container,

wherein the engagement head of the locking assembly includes a head protrusion residing within a non-linear track of the rotatable handle such that rotating the rotatable handle causes the engagement head to move non-rotatably vertically from a disengaged position to an engaged position thereby selectively disengaging or engaging the container mouth,

wherein, upon engagement of the container mouth with the engagement head, actuation of the inlet valve assembly directs flow of the motive fluid to the venturi injector assembly such that a concentrated chemical within the concentrate container is conveyed through the concentrate tube and into the concentrate supply line, and wherein the concentrated chemical is introduced into the motive fluid within the venturi assembly such that a mixed solution is dispensed through a solution outlet line on the venturi injector assembly.

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